Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

December 23, 2013
NOC-AE-13003065
10 CFR 50.12
10 CFR 50.90

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Response to STP-GSI-191-EMCB-RAI-1
(TAC NOs MF2400 and MF2401)

References:

1. Letter, D. W. Rencurrel, STPNOC, to NRC Document Control Desk, "Revised STP Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Resolving Generic Safety Issue (GSI)-191," June 19, 2013, NOC-AE-13002986 (ML131750250)

2. Letter, G. T. Powell, STPNOC, to NRC Document Control Desk, "Supplement 1 to Revised STP Pilot Submittal and Requests for Exemptions and License Amendment for Risk-Informed Approach to Resolving Generic Safety Issue (GSI)-191, " November 13, 2013, NOC-AE-13003043 (ML13323A183)

3. E-mail, Matthew Bartlett, NRC, to A. W. Harrison, STP, "Request For Additional Information (RAI) Regarding License Amendment for Risk-Informed Approach to Resolving Generic Safety Issue (GSI) 191 South Texas Nuclear Operating Company (STPNOC) South Texas Project (STP), Units 1 And 2, Docket Nos. 50-498 and 50-499", November 26, 2013 (ML13330B715)

4. Meeting Notes, Mohan C. Thadani, NRC, "Summary of September 13, 2010, Category 1 Meeting, Via Conference Call, with STP Nuclear Operating Company-Discussion Of Draft Responses to Request for Additional Information for Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors", October 13, 2010 (ML102810345)

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By email on November 26, 2013, (Reference 3) the NRC staff requested additional information (RAI) regarding the applications in References 1 and 2. The STPNOC response to the RAI is provided in the attachment to this letter.

This response was discussed and found to be acceptable by the NRC staff in a conference call on September 13, 2010. It is documented as RAI-49 in meeting notes dated October 13, 2010 (Reference 4).

There are no regulatory commitments in this letter.

If there are any questions, please contact Ken Taplett at 361-972-8416.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: December 23, 2013

Michael D. Meier
Vice President, Corporate Services

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Attachment: Response to STP-GSI-191-EMCB-RAI-1

cc:

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Response to STP-GSI-191-EMCB-RAI-1

References:

1. Enclosure to Letter From William H. Ruland, Director, Division of Safety Systems, Office of Nuclear Reactor Regulation, U. S. Nuclear Regulatory Commission, to Anthony Pietrangelo, Vice President, Regulatory Affairs, Nuclear Energy Institute, "Revised Content Guide for Generic Letter 2004-02 Supplemental Responses." November 21, 2007. (ADAMS Accession No. ML073110389)
2. Letter No. NOC-AE-08002372, From David W. Rencurrel, Site Vice President, South Texas Nuclear Operating Company, to U. S. Nuclear Regulatory Commission, Document Control Desk, "Supplement 4 to the Response to Generic Letter 2004-02," December 11, 2008. (Accession No. ML083520326)
3. Letter No. NOC-AE-13002986, From D. W. Rencurrel, Senior Vice President, Operations, South Texas Nuclear Operating Company, to U. S. Nuclear Regulatory Commission, Document Control Desk, "Revised STP Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Resolving Generic Safety Issue (GSI)-191," June 19, 2013. (Accession No. ML13175A211)
4. Letter No. NOC-AE-13003043, From G. T. Powell, Site Vice President, South Texas Nuclear Operating Company, to U. S. Nuclear Regulatory Commission, Document Control Desk, "Supplement 1 to Revised STP Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Resolving Generic Safety Issue (GSI)-191," November 13, 2013. (Accession No. ML13323A183)

NRC Question STP-GSI-191-EMCB-RAI-1:

Mechanical and Civil Engineering Branch (EMCB)

Item 3.k of Reference 1 requested licensees to summarize the structural qualification results and design margins for various components of the sump strainer structural assembly. In Reference 2, STPNOC, the licensee, provided a qualitative response regarding the structural analysis without any supporting quantitative data. Additional information is needed regarding actual and allowable stresses and design margins for the various components of the sump strainer structural assembly to clarify the inherent level of conservatism employed in the design. This information was not included in STPNOC submittals (References 3 and 4).

Please summarize the structural qualification results, including the actual and allowable stresses, and design margins for the various components of the sump strainer structural assembly.

STP Response:

The strainer assembly is installed using multiple individual strainer modules (20 per sump). Detailed structural analysis was performed on a single strainer module. The analysis is bounding and applicable to each of the 60 modules. Each sump pit is a 4' x 10' opening, covered by steel cover plates with a plenum box in the middle. The plenum box collects water from all strainer modules and directs the water down into the sump pit. Each strainer module is mounted to angle iron running along the floor. Where suitable floor embedded plates were available, the angle iron was attached to the embedded plates with welded clips. At other locations, the angle iron was welded to anchor plates and attached to the floor with concrete expansion anchors.

The results tabulated below are grouped into 3 categories: 1) strainer module components, 2) sump pit cover (cover plate, plenum box and connecting elements), and 3) floor mounting hardware (angle iron, clips, concrete expansion anchors). In the following tables, the term "Allowable" applies to stress, force per unit length or force, as applicable. The corresponding "Actual" value uses the same units as the "Allowable", to facilitate comparison. Most strainer components are A240, type 304 stainless steel, for which the allowable stress was computed based on a yield stress of either 23.2 ksi at 267 °F or 28.15 ksi at 128 °F. Two separate cases were considered, denoted as cases 1 and 2 in the following tables. The first case corresponds to maximum temperature (267 °F), which occurs early following a LOCA, while debris loading is low and resulting differential pressure is also low. Eventually the sump would experience the maximum debris loading, causing the maximum differential pressure. Because this occurs later, temperatures would have cooled greatly, to 128 °F. In the following tables, Case 1 is the early case (peak temperature, low differential pressure) and Case 2 is the long-term case (low temperature, peak differential pressure). As indicated above, the material properties differ, with Case 1 having the lower yield stress due to higher temperature.

The acronym "IR" stands for Interaction Ratio, which is nominally "Actual" divided by "Allowable". Since seismic loads are present, most components are subject to loads in multiple directions acting simultaneously. Code allowables may be different in different directions. (For example, AISC allows 0.6 *fy* for major axis bending and 0.75 *fy* for minor axis bending of plates; the axial allowable is generally lower and dependent on *kL/R* ratio.) Thus, IR is often not a direct ratio, but instead is the sum of multiple IR components. In cases where IR was computed from the sum of stress components combined using different allowables that are explicitly documented in the calculation, the tables conservatively list total stress and the *lowest* of the allowables, along with the true IR as reported in the structural calculation. "Actual" and "Allowable" correspond to the higher IR of cases 1 and 2. In cases where the directional stress components were not separated and documented individually in the calculation, only total IR is reported. **Whenever IR is one or less, the component meets the stress requirements of the applicable code.** Compliance with this requirement is confirmed by the results tabulated below.

Since allowables for safe shutdown earthquake (SSE) are higher than those for operating basis earthquake (OBE), the two cases are listed separately. In each of the following tables, the highest values of IR for SSE and OBE are highlighted in bold.

Summary of Structural Analysis Results - - Strainer Module Components

Component	Seismic Case	IR (1)	IR (2)	IR (max)
External Radial Stiffener	**OBE**	**0.74**	0.69	**0.74**
	SSE	0.86	0.74	0.86
Tension Rods	OBE	0.37	0.32	0.37
	SSE	0.40	0.34	0.40
Edge Channels	OBE	0.51	0.54	0.54
	SSE	0.71	0.71	0.71
Seismic Stiffeners	OBE	0.64	0.65	0.65
	SSE	0.66	0.63	0.66
Spacers	OBE	0.68	0.57	0.68
	SSE	0.56	0.48	0.56
Core Tube	OBE	0.04	0.04	0.04
	SSE	0.05	0.05	0.05
Perforated Plate	OBE	0.33	0.45	0.45
	SSE	0.53	0.54	0.54
Wire Stiffener (differential pressure only)	- - -	0.25	0.33	0.33
End Cover	OBE	0.40	0.49	0.49
	SSE	0.35	0.48	0.48
End Cover Welds	OBE	0.41	0.49	0.49
	SSE	0.35	0.43	0.43
Weld of External Radial Stiffener to Core Tube	OBE	0.19	0.17	0.19
	SSE	0.21	0.18	0.21
Weld of External Radial Stiffener to Seismic Stiffener	OBE	0.51	0.48	0.51
	SSE	0.58	0.52	0.58
Edge Channel Rivets	OBE	0.09	0.10	0.10
	SSE	0.11	0.12	0.12
Inner Gap Hoop Rivets	OBE	0.11	0.12	0.12
	SSE	0.14	0.14	0.14
End Cover Rivets	OBE	0.00	0.01	0.01
	SSE	0.01	0.01	0.01
Module-to-Module Sleeve	OBE	0.16	0.14	0.16
	SSE	0.20	0.17	0.20
Module-to-Module Latch Connection	OBE	0.60	0.62	0.62
	SSE	**0.92**	0.87	**0.92**
Mounting Pins (standard)	OBE	0.32	0.26	0.32
	SSE	0.31	0.27	0.31
Mounting Bolts (alternate)	OBE	0.20	0.22	0.22
	SSE	0.21	0.22	0.22
Clevis Hitch Pins	OBE	0.35	0.39	0.39
	SSE	0.38	0.39	0.39
External Radial Stiffener Mounting Tabs	OBE	0.14	0.14	0.14
	SSE	0.15	0.13	0.15
Weld of Radial Arm to End Plate	OBE	0.62	0.75	0.75
	SSE	0.48	0.56	0.56

CASE 1) Early Conditions - - peak temperature, low differential pressure (low debris)
CASE 2) Late Conditions - - peak differential pressure (max. debris), low temperature

Summary of Structural Analysis Results - - Items Spanning Sump Pit

Component	Seismic Case	Allowable	Actual	IR (1)	IR (2)	IR (max)
Cover Plate + Angle Iron + Tee (combined section)	OBE	18.6 ksi	7.96 ksi	0.41	0.43	0.43
	SSE	29.7 ksi	10.23 ksi	0.34	0.34	0.34
Angle Iron + Cover Plate (combined section)	OBE	18.6 ksi	11.85 ksi	0.58	0.64	0.64
	SSE	29.7 ksi	14.66 ksi	0.48	0.49	0.49
Cover Plate Bolts	**OBE**	**24.63 ksi**	**23.73 ksi**	0.76	**0.96**	**0.96**
	SSE	**39.40 ksi**	**27.83 ksi**	0.58	**0.71**	**0.71**
Weld connecting T to cover plate	OBE	2.11 k/in	1.39 k/in	0.59	0.66	0.66
	SSE	3.38 k/in	1.66 k/in	0.46	0.49	0.49
Plenum Box plate panels	OBE	21.1 ksi	13.43 ksi	0.51	0.64	0.64
	SSE	33.8 ksi	14.94 ksi	0.37	0.44	0.44
Plenum Box + Cover Plate (combined section)	OBE			0.47	0.50	0.50
	SSE			0.43	0.42	0.43
Plenum Box perimeter angles	OBE			0.76	0.86	0.86
	SSE			0.63	0.67	0.67
Plenum Box panel welds	OBE	2.81 k/in	0.112 k/in	0.03	0.04	0.04
	SSE	4.50 k/in	0.125 k/in	0.02	0.03	0.03
Weld between plenum box panels and perimeter angles	OBE	2.11 k/in	0.43 k/in	0.18	0.21	0.21
	SSE	3.38 k/in	0.51 k/in	0.14	0.15	0.15
Plenum Box Access Cover Bolts	OBE			0.18	0.25	0.25
	SSE			0.13	0.17	0.17

Summary of Structural Analysis Results - - Floor Mounting Hardware

Component	Seismic Case	Allowable	Actual	IR (1)	IR (2)	IR (max)
Angle Iron Tracks	OBE	13.9 ksi	7.49 ksi	0.54	0.54	0.54
	SSE	22.3 ksi	13.64 ksi	0.61	0.58	0.61
Anchor Plates	OBE	21.1 ksi	12.72 ksi	0.58	0.60	0.60
	SSE	27.8 ksi	20.96 ksi	0.75	0.71	0.75
Weld of Angle Iron to Anchor Plate	OBE	1.74 k/in	0.17 k/in	0.10	0.09	0.10
	SSE	2.78 k/in	0.28 k/in	0.10	0.09	0.10
Hold Down Bars	OBE	13.9 ksi	5.47 ksi	0.36	0.32	0.36
	SSE	22.3 ksi	10.03 ksi	0.42	0.36	0.42
Weld of Hold Down Bars to Angle Iron Tracks	OBE	1.16 k/in	0.46 k/in	0.40	0.35	0.40
	SSE	1.86 k/in	0.88 k/in	0.47	0.41	0.47
Concrete Expansion Anchors	SSE	3100 lb	Tension = 2028 lb Shear = 818 lb	0.92	0.71	0.92
Standard mounting clips	OBE	21.1 ksi	12.41 ksi	0.53	0.59	0.59
	SSE	33.8 ksi	16.61 ksi	0.48	0.49	0.49
Welds on standard mounting clips	**OBE**	**2.90 k/in**	**2.78 k/in**	**0.96**	0.78	**0.96**
	SSE	**3.71 k/in**	**3.58 k/in**	**0.96**	0.93	**0.96**
Alternate (taller) mounting clips	OBE	17.7 ksi	12.41 ksi	0.62	0.70	0.70
	SSE	28.4 ksi	16.61 ksi	0.56	0.58	0.58
Welds on alternate mounting clips	OBE	2.37 k/in	1.77 k/in	0.74	0.75	0.75
	SSE	3.18 k/in	2.56 k/in	0.80	0.76	0.80

CASE 1) Early Conditions - - peak temperature, low differential pressure (low debris)
CASE 2) Late Conditions - - peak differential pressure (max. debris), low temperature